



Evaluation of NO_x emission uncertainties based on car-MAX-DOAS observations and CHIMERE model simulations during the MEGAPOLI campaigns in Paris in Summer 2009 and Winter 2009/10

Reza Shaiganfar (1), Herve Petetin (2), Steffen Beirle (1), Matthias Beekmann (2), and Thomas Wagner (1)

(1) Max Planck Institute For Chemistry, Mainz, Germany (r.shaiganfar@mpic.de), (2) LISA (Laboratoire Interuniversitaire des Systèmes Atmosphériques)

Within the European project MEGAPOLI we performed two extensive car-MAX-DOAS campaigns around Paris in August 2009 and January/February 2010. The car-MAX-DOAS observations are conducted on circles with different radii around the city with the aim to quantify the NO_x emissions from the area inside the circles. The method is based on the combination of the retrieved tropospheric NO₂ column densities with wind fields. In this way the influx and the outflux can be calculated; the difference of both represents emissions from the encircled area. Since the car-MAX-DOAS observations are only sensitive to NO₂, the derived NO₂ emissions have to be upscaled to the total NO_x (NO + NO₂) emissions from megacity. Also corrections for the rather short lifetime of NO_x have to be applied.

In our study we investigate the uncertainty of the method with respect to different measurement parameters and wind conditions. For that purpose we make use of model simulations from the regional CHIMERE model. First we sample the modelled NO₂ fields at the exact locations and times of the car-MAX-DOAS measurements. Second, we apply the method for the determination of the NO_x emissions to this sampled model data. Third, we compare the derived emissions to the input emissions used in the model simulations. From the comparison we identify critical parameters for the application of our method and develop a method for the determination of the uncertainty of the derived emissions. Largest errors are found for situations with low wind speed and/or high variability of the wind speed or direction during the period of the measurements. Also gaps or road segments close to the city center cause larger errors. Finally, we apply the method to the car-MAX-DOAS observations and compare the derived emissions to existing emission inventories.